Fine- and micro-scale observations in the Oyashio in winter

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During the R/V Hakuho-maru cruise in Mar. 2015, fine- and microstructure measurements in the Oyashio water were conducted using a CTD/LADCP and vertical microstructure profiler in order to know the spatial variability of wintertime turbulence field, which has not been reported so far at this area. At a station off the shelf break, whose bottom depth is about 530 m, one-day repeated observations were also conducted to know the temporal variability of turbulence intensity.
The energy dissipation rate, ε, was patchily elevated to $O(10^{-8})$ [W/kg] and was typically $O(10^{-10} - 10^{-9})$ [W/kg] in the upper 400 m depth (less dense than 27.0 σ_θ) across the Oyashio. Off the shelf break, where the one-day observation was conducted, strong turbulence with $\varepsilon = O(10^{-7})$ [W/kg] and $K\rho = O(10^{-3} - 10^{-2})$ [m^2/s] was observed at around 60 - 70 m depth (26.4 σ_θ), and $\varepsilon = O(10^{-8})$ [W/kg] and $K\rho = O(10^{-3})$ [m^2/s] at around 350 m depth (26.7 σ_θ) corresponding to the period of isopycnal heaving of about 50m. This strong mixing around 26.4 σ_θ(26.7 σ_θ) was enhanced when the along-isobath (down-sill) flow and its associated shear was strengthened. Harmonic analysis shows that the diurnal tidal flow was large in the upper 50 m, while the mean and semi-diurnal flow were also important at around 26.7 σ_θ suggesting that the tidal flow may impact on the turbulence field at this place.

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